Aalto University
School of Business

LONG-TERM IMPACTS OF STARTUP ACCELERATORS

Master's Thesis

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Spring 2018

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Abstract of master's thesis

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Title of thesis Long-term impacts of startup accelerators

Degree Master of Science in Business Administration

Degree programme Finance

Thesis advisor(s) Vesa Puttonen

Year of approval 2018 **Number of pages** 53 **Language** English

BACKGROUND AND OBJECTIVES OF THE STUDY

Over the past decade startup accelerators have become key players in startup ecosystems. The first modern type startup accelerator was founded in 2005. Due to the novelty of this phenomenon, there has been only very little academic literature on the long-term impacts of startup accelerator programs. This thesis studies companies that have completed startup accelerator programs at the time they get acquired. The study offers relevant insights for both entrepreneurs considering participating in accelerator programs and for corporations that consider partnering with accelerators or acquiring one of their portfolio companies.

DATA AND METHODOLOGY

This study uses a novel data set collected from public online startup databases such as Crunchbase. The data set covers startups that were acquired by a public U.S. based company between August 2006 - April 2016 and had participated at least in one startup accelerator program. For a startup accelerator to be included in the sample, it must be a for-profit organization and have had at least on exit where the portfolio company was acquired by a public company. The 'accelerated' startups were matched with a similar company that was acquired to compare the differences in the acquisitions. Furthermore, I categorize the startup accelerators in the sample in two groups based on their size and performance to study the impact of the quality of the accelerator programs.

FINDINGS OF THE STUDY

I find that abnormal stock returns around the announcement date are higher when the acquisition target is a startup accelerator backed company rather than a company backed only by regular venture capital investors. Further comparative analysis shows that 'accelerated' companies get acquired signicantly younger than their peers. The results also suggest that these differences hold when most prominent accelerators with most success are excluded from the sample. However the companies accelerated by the most prominent accelerators seem to have much more success in terms of attracting investors and raising funding.

Keywords Startup, startup accelerator, venture capital, acquisitions

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Maisterintutkinnon tutkielman tiivistelmä

Tekijä Joonas Wallenius

Työn nimi Startup-kiihdyttämöiden pitkän aikavälin vaikutukset

Tutkinto Kauppatieteiden maisteri

Koulutusohjelma Rahoitus

Työn ohjaaja(t) Vesa Puttonen

Hyväksymisvuosi 2018 **Sivumäärä** 53 **Kieli** Englanti

TUTKIELMAN TAUSTA JA TAVOITTEET

Viimeisen vuosikymmenen aikana startup-kiihdyttämöt ovat vakiinnuttaneet asemansa startup-ekosysteemeissä. Ensimmäinen moderni startup-kiihdyttämö, Y Combinator, perustettiin vuonna 2005. Y Combinatorin menestyksen myötä maailmalla on perustettu jopa satoja samaan malliin perustuvia kiihdyttämöitä. Ilmiön uutuuden vuoksi akateeminen tutkimus startup-kiihdyttämöistä on keskittynyt lähinnä niiden lyhyen aikavälin vaikutuksiin. Tämä tutkielma keskittyy startup-kiihdyttämöiden pitkän aikavälin vaikutuksiin. Erityisenä merkkipaaluna kiihdyttämöohjelmiin osallistuneiden yritysten pitkän aikavälin kehityksessä voidaan pitää yritysostoa, jossa vakiintunut yritys ostaa kiihdyttämöohjelmaan osallistuneen yrityksen. Tutkielman tavoitteena on tarjota näkemystä sekä yrittäjille, jotka harkitsevat osallistumista kiihdyttämöohjelmaan, kuin myös yrityksille, jotka harkisevat startup-kiihdyttämöiden kanssa yhteistyötä tai niiden portfolioyrityksen ostoa.

LÄHDEAINEISTO JA TUTKIELMASSA KÄYTETTY METODOLOGIA

Tutkielmassa käytetään dataa, joka on kerätty julkisista startup-yrityksiin keskittyvistä tietokannoista. Yksi näistä tietokannoista on muun muassa Crunchbase. Kerätty data käsittää Yhdysvaltalaisiin kiihdyttämöohjelmiin osallistuneet yritykset, jotka Yhdysvalloissa julkisesti listattu yritys on ostanut elokuun 2006 ja huhtikuun 2016 välisenä aikana. Startup-kiihdyttämöiden rajauksen ulkopuolelle jätettiin voittoa tavoittelemattomat kiihdyttämöt ja kiihdyttömät, joiden portfolioyrityksistä yhtäkään ei ole ostanut Yhdysvalloissa julkisesti listattu yritys. Lisäksi tutkielmassa verrataan kiihdyttömöohjelmiin osallistuneita yrityksiä muihin riskipääomasijoittajien portfolioyrityksiin. Tutkielmassa verrataan myös eri startup-kiihdyttämöiden kokojen ja tunnettavuuden vaikutusta niiden pitkän aikavälin tuloksiin.

TUTKIELMAN KESKEISET LÖYDÖKSET

Yritysostot, joissa kohde on startup-kiihdyttömön portfolioyritys, vaikuttavat normaalista poikkeavaa positiivisemmin ostavan yrityksen osakekurssiin verrattuna yritysostoihin, joissa kohde ei ole osallistunut kiihdyttömöohjelmaan. Lisäksi vertailu paljastaa, että kiihdyttömöohjelmiin osallistuneet yritykset ostetaan merkittävästi nuorempina kuin verrokkiyritykset. Vähemmän tunnettuihin kiihdyttömöihin mediassa kohdistuneesta kritisisoinnista huolimatta edellä mainitut tulokset pitävät vaikka vertailun ulkopuolelle rajataan tunnetuimpien kiihdyttömöiden portfolioyritykset. Kiihdyttämöiden välinen vertailu kuitenkin paljastaa, että tunnetuimpien kiihdyttömöiden portfolioyritykset houkuttelevat muita enemmän sijoittajia ja keräävät enemmän rahoitusta.

Avainsanat Startup, startup-kiihdyttämö, pääomasijoittaminen, yritysostot

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1 INTRODUCTION

Along with the boom in startups in recent years, new types of ecosystem players have emerged. One type of these new ecosystem players are startup accelerators. Paul Graham founded Y Combinator in 2005, which is considered by many to be the first the modern type startup accelerator. Today, there are hundreds of startup accelerators around the world with estimates varying between 300 and over 2000 (Cohen and Hochberg, 2014). Alone in the United States, there were 172 startup accelerators, up from only 16 accelerators in 2008. These accelerators have invested in more than five thousand U.S. based startups with a median investment of one hundred thousand dollars during the 2005 to 2015 period. These companies raised over 19.5 billion dollars in funding during this time period (Hathaway, 2016). Many of the world's currently most valuable startups such as AirBnB, DropBox and Stripe have participated accelerator programs. Earlier studies show that startup accelerators can have a significant positive impact on the performance of the startups that participate in their programs, even when compared with other early-stage investors.

Startup accelerators have received a lot of attention, but they have also been studied very little in academic literature. Given the relative newness of the phenomenon, there are no publicly available large datasets related to it. Thus there is only a handful of papers studying startup accelerators. Most of this academic literature focuses on the short-term impacts of startup accelerators. However an imporant long-term milestone for many nascent companies is getting acquired by a larger company. An acquisition is the most common way for an entrepreneur and early-stage investors to get a meaningful exit while initial public offerings are relatively rare, especially when it comes to startup accelerators' portfolio companies. Thus the time of an acquisition is a suitable point in time to study the long-term impacts of startup accelerators. Using a hand-picked sample, this paper studies how startup accelerator backed firms and firms backed only by 'regular' venture capital investors differ along various dimensions at the time of their acquisition. I also study whether there are differences between different accelerators' long-term impacts. Critics of startup accelerators claim that only the most premier accelerators have a positive impact on startups that participate in their programs. Some weaker accelerators have been even claimed to be harmful for entrepreneurs taking part in their programs. After all, equity is the most valuable currency entrepreneurs have and accelerators take a significant equity stake in their portfolio companies in return for a relatively small cash investment. In this paper I show that participating in a premier accelerator program is almost

always a better choice for an entrepreneur. However as the top programs are highly selective, many entrepreneurs are left with a choice of participating in a weaker accelerator program or not participating in an accelerator program at all. Many entrepreneurs have been very successful and have had meaningful exits even without participating in an accelerator program. Therefore, I analyze whether it makes sense for an entrepreneur to participate in a weaker accelerator program by comparing companies that went through these programs with companies that only had 'regular' venture capital funding at the time of their acquisition.

Studying acquisitions also opens an interesting new avenue of research. Almost all previous literature discusses the impacts of startup accelerators solely from an entrepreneur's perspecitve. To my knowledge, no one has ever studied the acquisitions of startup accelerators' portfolio companies from the acquirer's perspective. As startup accelerators' portfolio companies are often at the forefront of developing new disruptive technologies or services, their acquisitions could signal valuable information about the acquiring company's future plans to the stock markets. There are few papers, which study how the involvement of venture capital affects acquirer returns. However given that there are significant differences between normal venture capital investors and startup accelerators, a comparison of acquisitions involving the two different types of investors is in place.

Even though it is out of the scope of this paper, I also give an overview of the relationships between established companies and startup accelerators to depict a larger picture. Especially for large technology companies, partnering with a startup accelerator may have two motives; investing in startup accelerators can generate a return on the company's cash while also gaining insight into new startups and technologies that may be of strategic interest to the company. In some cases large companies might even partner with a startup accelerator to create a corporate accelerator program. Corporate accelerators operate rather similarly to regular accelerator programs but they derive their objectives from the sponsoring organization (Heinemann, 2015). This phenomenon is related to corporate venture capital, which is another topic that has gained much attention recently but it is out of the scope of this paper.

The purpose of this paper is to increase the overall understanding about startup accelerators. I aim to provide relevant insights both to entrepreneurs considering participating in one of the startup accelerator programs as well as to large companies that are considering partnering with a startup accelerator. My study adds to the existing literature by analyzing the effectiveness and long-term impacts of accelerator programs with empirical evidence. Furthermore,

this paper confirms some of the findings in previous literature with a new sample. The remainder of this paper is structured as follows. In section 2, I provide a definition of a startup accelerator, give an overview of existing literature on them and discuss their ties with other types of investors as well as corporations. In section 3, I review other related literature such as literature about motives for acquiring venture-backed firms, circumstances where acquirers can earn abnormal returns and the roles played by venture capitalists and startup accelerator firms in acquisitions of their portfolio companies. Section 4 goes over the hypotheses. Section 5 gives an overview of the data used in my study and then explains the methdology. Section 6 contains the empirical results and discusses the findings as well as how they relate to previous literature. Section 7 looks at the limitations of this paper. Section 8 concludes and gives suggestions for further research.

2 ABOUT THE ESSENENCE OF STARTUP ACCELERATORS

2.1 Defining a startup accelerator

Startup accelerators are often confused with other early types of organizations supporting startups such as incubators and angel investors. Table 1 summarizes the key differences between the aforementioned types of organizations.

Table 1.

Summary of differences between startup accelerators, incubators and angel investors

	Accelerators	**Incubators**	**Angel investors**
Duration	3-6 months	1-5 years	Ongoing
Cohorts	Yes	No	No
Business model	Investment / non-profit	Rent / non-profit	Investment
Selection frequency	Competitive, cyclical	Non competitive	Competitive, ongoing
Venture stage	Early	Early or late	Early
Education offered	Seminars	Ad hoc, hr / legal	None
Venture location	Usually on-site	On-site	Off-site
Mentorship	Intense	Minimal, tactical	As needed, by investor

Source: Cohen, Hochberg. 2014. "Accelerating startups: The seed accelerator phenomenon". SSRN Journal, March 2014, 1-16.

Miller and Bound (2011) have listed five main features that comprise a startup accelerator program model. First, accelerators have an application process that is publicly open, but are highly competitive. In fact the acceptance rates of the most prominent accelerators in recent years have varied between less than 1% and 6%. Second, accelerators provide early-stage investment, typically in exchange for equity. Third, accelerators tend to focus on small teams instead of individual entrepreneurs. Fourth, accelerators provide time-limited support including programmed events and mentoring. Last, accelerators typically have cohorts or groups of startups instead of investing in individual companies ongoingly. It is this combination of features that sets accelerators apart from other approaches to investment or business incubation.

To summarize, for the purposes of this paper I define a startup accelerator program as follows:

*A **startup accelerator** is an organization that organizes fixed-lenght programs that provide mentorship, networking, office space and education components to nascent firms . The programs vary typically between 3-6 months in length, take in groups of startups for each program and culminate in a demo day or a pitch event.*

Furthermore, this paper focuses only on for-profit accelerators that provide capital in exchange for equity. In fact, only 60% of North American accelerators are for-profit ventures and 66% take equity in their portfolio companies (Global accelerator report 2016, Gust). Thus there are some accelerator programs that take equity but are at the same time not for-profit organizations. This distinction is therefore necessary as the motives for these different types of accelerator programs are different.

2.2 The role of startup accelerators in the venture capital ecosystem

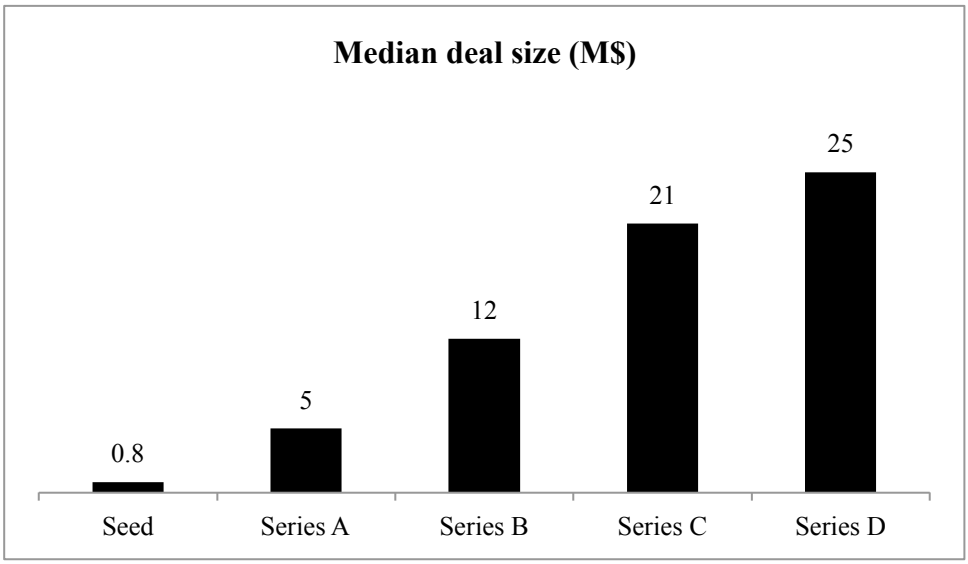
Startup accelerators don't provide major funding to their portfolio companies but they take a relatively significant share of equity in exchange for participating in their programs. The average investment by U.S. accelerators in 2016 was only slightly more than 36,000$ (Global accelerator report 2016, Gust). Even though the accelerators might make follow-on investments after an accelerator program has ended, this is still a signicantly smaller figure when compared to typical venture capital investment rounds. Figure 1 shows the median venture capital deal sizes in the United States in 2016.

As the value of a startup accelerator's investments in portfolio companies typically goes up only when startups raise more funding, the main motive for accelerators is that process. Startups which have recently completed an accelerator program have relative small valuations, on average around 7 million dollars (Hathaway, 2016). This makes them somewhat too small to become acquisition targets in most cases and certainly too small to be able to bear the costs of an IPO process. Instead, having participated in a prominent accelerator program signals to potential investors high quality (Kim and Wagman, 2014).

Figure 1.

Median venture capital deal sizes in the US in 2016

The figure shows the median venture capital deal size by financing round. The financing rounds are also called series in venture capital terms. Seed round is typically the first round of major funding for a startup but some might have raised smaller amounts before seed round. Multiple investors might participate in any given financing round.



Source: Venture Pulse Q4/2017, KPMG

Accelerator programs are known by investors to use unique and comprehensive selection criteria and thus have higher success rates for their graduates. (Hoffmann and Radojevich-Kelley, 2012). The typical selection process used by the most startup accelerators usually starts with an application phase for a specific program. Most prominent startup accelerators can receive thousands of applications for each program. The accelerators then go through the applications and do their due diligence. Most promising startups are invited to a round of interviews after which the startups for the program are selected[1]. The criteria for selecting the startups typically involve evaluating the applying startup's team composition, product, business model, traction for the business, earlier funding and long-term vision. These criteria are not often public but for example 500 Startups, a highly popular and one of the most prominent startup accelerators, published the following six characteristics (called BLASTR) they look at in startups[2]:

- ***Balanced,*** *smart team that can learn quickly and be persistent.*
- ***Launched*** *product.*

[1] The application process varies between startup accelerators. More information can be found on each accelerator's website such as for

[2] 500 Startups' BLASTR evaluation characteristics adapted from "10 tips for getting into our next accelerator batch" –article available on 500 startups' website: https://500.co/ten-tips-for-getting-in/

- ***Aspirations*** *to use 500 Startups' growth resources to help grow and/or raise a big seed round.*
- ***Strong*** *understanding of the customer and unit economics behind the business.*
- ***Traction.*** *Early but recognizable traction.*
- ***Raised*** *some money previously.*

Depending on the accelerator, some accelerators might also give preference to startups that have contacts with people who are associated with the accelerator, such as the accelerator's employees, mentors or alumni.

Startups accelerators have rather close ties with angel investors and venture capital investors as they want them to invest in their portfolio companies. Often this includes inviting them to demo days where the startups present their businesses. Some startup accelerators also organize separate investor days, which are events designed to facilitate meetings between the portfolio companies and potential investors. Furthemore, some startup accelerators also have a more direct connection to angel investors and venture capital investors as they may invest in the startup accelerator's fund. The motive behind supporting the startup accelerators is that they create a pipeline of companies that other investors can invest in (Miller and Bound, 2011). Thus the accelerators' value created for investors is having the mechanisms to scout and filter for talent in place.

2.3 The effectiveness of startup accelerators

The majority of existing literature on startup accelerators focuses on their effectiveness, mostly from a startup's perspective. As noted in previous sections, accelerators have close ties with other types of investors. This is one of the startup accelerators' main value propositions to startups considering participating in one of their programs. Many studies find that acceletators increase the success rates of startups by providing entrepreneurs with access to angel and venture capitalist which tend to, on their part, increase overall success rates (Hoffman and Radojevich-Kelley, 2016 & Hathaway, 2016). Regmi, Ahmed and Quinn (2015) provide a data driven analysis in their paper on how much startup accelerators impact the success rates. They find that accelerator graduates have circa 23% higher survival rates than other startups in the United States. They define survival as a startup still operating or having exited (acquisition or IPO) after certain time period from founding the company. What is perhaps even

more critical to startup survival, is not the fact that they are able to attract venture capital investment, but how soon they can raise the capital. As capital is often needed to reach other key milestones faster, such as gaining customer traction, participating in an acceletor program can clearly be more beneficial than getting the initial investment from other types of investors (Winston-Smith and Hannigan, 2015).

Hallen, Bingham and Cohen (2016) study what is driving the effectiveness of startup accelerators and the positive effects associated with them. Even though they find some evidence for admitting only a small percentage of applicants and the argument that higher quality entrepreneurs are more likely to apply to accelerator programs, they argue that consultation provided by accelerators is the main driver for better venture outcomes. They find that startups receive intensive consultation during accelerator programs in form of meeting with mentors, accelerator directors, sharing learnings with other entrepreneurs in the program and almost daily seminars by relevant subject matter experts. Startups are also encouraged to interact actively with customers during the accelerator programs. This learning mechanism coupled with connecting with potential investors seems to result in best outcomes.

Some papers find that the positive effects to startup founders can only be attributed to the leading accelerators. Some papers even go further to make the argument that outside of the most prominent accelerators, the impact of participating in an accelerator program may be ambiguous or even negative (Hathaway, 2016 & Hallen, Bingham and Cohen, 2014). As cohort sizes have significantly increased over time, accelerators may have a harder time signaling the quality of startups to potential investors (Kim and Wagman, 2014). Especially, entrepreneurs with venture-backed founding experience may gain less benefit from participating in an accelerator program. However, for novice entrepreneurs accelerators can provide those valuable connections with venture capitalists that might take them a longer time to make on their own (Zhang, 2007).

2.4 Ties between startup accelerators and corporations

Since the launch of first startup accelerator programs, the relationships between accelerators and corporations have grown in stregth. From startup accelerators' perspective the reason to co-operate with corporations is mostly to ensure financial sustainability of the accelerator as relying solely on exits from investments in their portfolio companies can take a long time to

realize. Global Accelerator Report (Gust, 2016) surveyed 579 accelerators around the world and found that more than half of them were at least partially funded by a corporation. 67% of the surveyed accelerators also aimed to generate more revenue from services sold to corporations. These services mainly include while-label or jointly-run acceleration programs run by the accelerator on behalf of the corporation and corporation sponsorship packages. In addition to short-term financial motives, corporations can also increase the prospects of accelerators' portfolio companies, which translates into more exits for the accelerator in the long-term. These mechanisms include potentially selling services, raising funding or getting acquired by these corporations.

From a corporations' perspective, startup accelerators are an efficient and effective way to engage with startups. By partnering with accelerators, corporations can access the accelerators' marketing power and networks which enable launching a program much quicker than corporations would be able to do on their own. Corporations can also boost their own brand by aligning with accelerators and their portfolio companies which are seen as symbols of innovation in the eyes of the public. However perhaps the most important benefit for corporations is accessing the accelerators' deal flows. This gives corporations insight into the latest innovations in their market. Corporations can also build a more innovative culture within their organization by placing executives as mentors in accelerators (Global accelerator report 2016, Gust).

3 LITERATURE REVIEW

In this section, I review the relevant literature and present relevant studies in order to provide further background information about the topics of my thesis. I start by exploring the motives for acquiring venture-backed firms. All companies in my sample have raised venture capital funding and almost without exception they can be considered as high-technology firms. Therefore I focus more spesifically on literature on sourcing technological knowledge and innovation through acquisitions. Second, I look under which circumstances acquirers can earn abnormal returns. Third, I take a closer look why so many new ventures eventually get acquired over other exit methods. In order to construct a complete picture, I also study startup accelerators' motives when it comes to exiting their investments.

3.1 Motives for acquiring venture-backed firms

The average company lifespan on the S&P 500 index has decreased dramatically from 61 years in 1958 to only 18 years in 2012 (Innosight 2012). There are naturally multiple reasons but the most impactful driver of this shift has been the accelerating pace of technological innovation. As we have witnessed over the past few years, new technology-enabled entrants have the ability grow quickly and pose serious threats to industry incumbents. When faced with risks of becoming obsolote driven by new technologies, large companies can either perform their own research and development or acquire new entrants who are successfully innovating, as noted by Banker, Wattal and Plehn-Dujowich (2011). Complementing internal research and development efforts with aggressive acquisition programs has been a growing trend now for years especially in high-technology industries (Ransbotham and Mitra, 2010). Compared to internal research and development efforts, acquisitions provide large companies with a quick access to key technologies, talent and capabilities. Even the companies, which are considered to be the most innovative in the world have actually acquired some of their most iconic innovations. For example, Google bought Android and Apple bought Siri. Indeed, acquisitions of small private firms is a viable research and development strategy to explore a range of potential future innovation opportunities (Ismail, 2008).

3.2 When do acquirers earn abnormal returns?

It has been well documented in the academic literature that acquirers of private targets perform better than acquirers of public targets around the announcement date. While there are significant positive returns associated with acquiring private targets, announcements of acquiring public targets are often found to destroy value. This has been documented in all advanced markets such as U.S. (Capron and Shen, 2007 & Fuller, Netter and Stegemoller, 2002) and western Europe (Faccio, McConnell and Stolin, 2006). Fuller, Netter and Stegemoller (2002) argue that buyers in somewhat illiquid market for assets, in this case private firms, do not pay as high price for a firm as compared to public targets. They conclude that there is a discount for illiquidity and buyers capture it. Furthermore, Capron and Shen (2007) find that less information available on private target firms creates more opportunities for exploiting private information.

The relative size of the acquisition target compared to the acquiring company has been found to predict performance. Sirower (1997) finds that acquisitions where the target is less than 10 percent the size of the acquirer have a higher chance of success because there is a more detailed understading of the businesses and quicker integration potential. King, Slotegraaf and Kesner's (2008) finding that when the acquisition target is less than half of the size of the acquirer, the acquisition is associated with higher performance, supports this argument. It is also worth mentioning here that the size of the acquirer itself can be reflected in shareholder returns. Moeller, Schlingemann and Stulz (2004) found in their study that the announcement return to the acquiring firm is approximately two percentage points higher for small acquirers, regardless of the form of financing and even whether the acquisition target firm is private or public. A related factor to relative size of the acquisition target is its age. Ransbotham and Mitra (2010) argue that there are two kinds of benefits from acquiring younger targets. First is that there are various growth options that provide greater opportunities for a synergistic fit. Second is that there is a greater uncertainty in the valuation of the target company that leads to a lower price.

Finally, acquirers can impact their performance with target selection and by helping increase the acquired firm's probability of success in the market competition. Capron and Pistre (2002) find that acquirers do not earn abnormal returns when they only receive resources from the target. In this case it is more probable that various bidders could have captured these resources and thus have competed away any abnormal returns. Instead acquirers should expect to

earn abnormal returns if they transfer their own resources to the target firm such as product innovation capabilities and subject matter expertise.

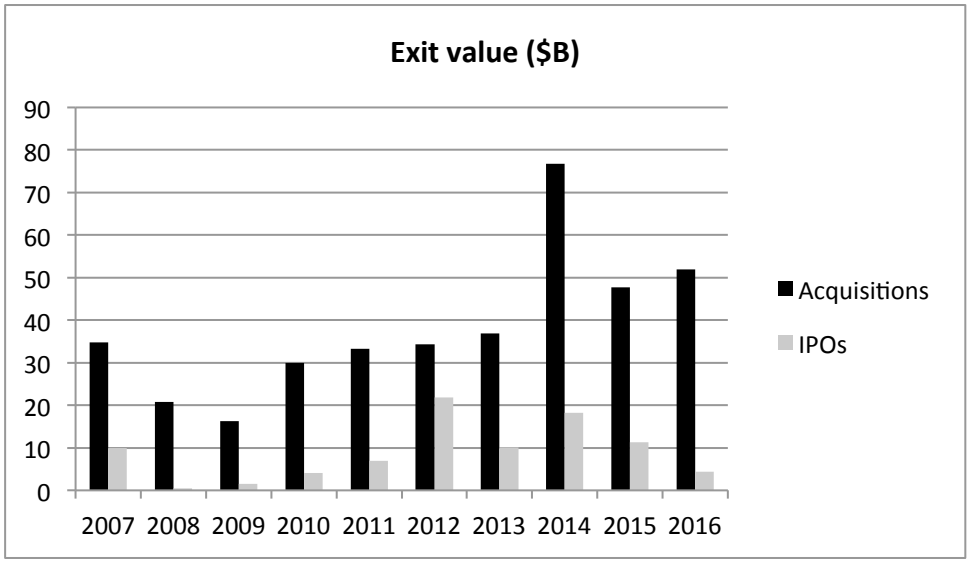
3.3 The role of venture capitalists in acquisitions

In 2016, for every dollar of IPO proceeds, 143 dollars were spent on mergers and acquisitions (CNBC, 2017). Both IPOs and acquisitions allow investors in private companies to cash out. It is worth noting that while some mergers are between two public companies, the volume of acquisitions involving private targets is significantly higher than that of including publicly traded firms. When it comes to comparing exits only by venture-backed firms, the difference in the size of IPOs and acquisitions as exit types is smaller but still significant.

Figure 2.

VC-backed exits value

The figure shows the total value of North America and Europe VC-backed exit activity both for acquisitions and IPOs.



Source: Pitchbook annual VC liquidity report 2016

Bayar and Chemmanur (2006) find that many firms would be able to obtain higher valuations in the IPO market but nevertheless choose to be acquired. They list few factors that drive the choice between IPO and acquisitions. First they argue that firm insiders have private informa-

tion about the success probablity in product market competition. However this information asymmetry varies between different exit mechanisms. Insiders' information advantage over IPO market investors is more likely to be higher while information asymmetry relative to potential acquirers tends to be smaller. In fact, common investors can actually help reduce information asymmentries associated with the transaction by forming a bridge between the acquiring firm and the target firm. Acquisition announcement returns are also likely to be more positive for acquisitions in which the acquirer and target share a common venture capital investor (Gompers and Xuan, 2008). Second, Bayar and Chemmanur argue that while an entrepreneur derives benefits of control as well as cash flow benefits from managing the firm, the venture capitalist will make the exit choice based on financial considerations alone.

Ragozzino and Blevins (2016) study in their paper how venture capital involvement affects the likelihood of firms going public or being acquired. They find that the number of venture capital firms invested in a firm is correlated with a higher probability of an acquisition of the firm; on average about 3 percent for every additional venture capitalist that funds the firm. However their paper does not find evidence for their hypothesis that the total dollar amount invested in a company by venture capitalists would increase the likelihood of exit via acquisition (in the case of IPOs the total amount invested heavily increases the odds of going public). Raising venture capital is usually very critical for an early stage firm to stay alive and continue their growth. Ragozzino and Blevins also find that there is a negative relationship between the time it takes a startup to raise its initial round of financing from venture capitalists and the probability of exit. For each year after founding that a startup does not get its first investment, the probability of an exit decreases by 13%.

Acquirer returns are on average higher when acquiring venture capital investor backed firms. Masulis and Nahata (2011) find that the average acquirer returns on announcement are two percentage points higher for venture capital backed targets as compared to other private target firms. There are two main reasons for this documented in academia. Firstly, exits are not only optional for venture capital funds. Most venture capital funds have a fixed maturity, usually ten years with an option to extend for a couple more years. Therefore venture capital firms that wish to stay in business must first successfully raise funds, invest the funds in new businesses, then exit the portfolio companies and return the money and profits to the fund investors, who in turn are expected to reinvest the proceeds with the same venture capital firm. Thus venture capital investors and startup founders may have incentives to seek different exit strategies. Venture capitalists tend to acquire increasing control over exit in the later stages of

investment in a company by securing additional board seats and by obtaining contractual exit rights. This results in a sophisticated transfer of control from the founders to venture capital investors when financial investments increase (Smith, 2005). The second explanation is that venture capitalists may have close (usually financial) ties to acquirers, which creates a conflict of interest between venture capitalist and other investors. The conflict of interest can outweigh negotiation skills and certification benefits that venture capitalists provide to their portfolio companies during the acquisition negotiation process (Masulis and Nahata, 2011).

3.4 The role of startup accelerators in exits

Startup accelerators don't provide major funding but they still usually own a significant share of their portfolio companies. That is, accelerators gain on their investments when their portfolio companies attract subsequent investments (it is rare that a firms value decreases when it receives new round of venture capital, however it does happen). Accelerators gain valuable private information as they work very closely with their portfolio companies during accelerator programs. Usually the relationship does not end after demo day. For example, one of the most prominent accelerators, Y Combinator, has a wide variety of resources available for its alumni network ranging from community activies (such as gatherings, formal events and online platforms), advice (for example workshops, conferences, office hours with Y Combinator partners) and capital investments in subsequent funding rounds[3].

The most prominent accelerators are known to advice their portfolio companies around the acquisition process. Even though the accelerators don't typically hold enough equity share in their portfolio companies to have control over the timing of exit, Kim and Wagman (2014) find that accelerators have incentives to exit their investments early in case they receive negative signals about a portfolio company. In other words, accelerators wish to exit early if a portfolio company seems to have less potential than initially thought. This of course does not make a portfolio company worthless but accelerators have less incentive to wait for full information disclosure (or in other words wait to see how things turn out for the company). Furthermore, accelerators rely on part on their track records to attract high quality startups to participate in their programs. While accelerators might want to hold on to the most promising

[3] A more detailed list of resources available to Y Combinator founders and alumni can be found on their website: https://www.ycombinator.com/why/

portfolio firms in hopes of big exits, acquisitions of other portfolio companies are important in maintaining an attractive brand.

4 HYPOTHESES

This section presents the hypothesis of this study which are based on previous literature and the research questions of my study. After each set of hypotheses, I explain the related theory and reasoning.

H1: Startup accelerator backed firms give more control over exit to their investors than other venture-backed firms.

As noted by Masulis and Nahata (2011), venture capital firms have to exit their investments after a certain time period in order to stay in business. The more control investors have over a firm, for example in terms of equity share or board seats, the more they can impact the timing of the exit and the acquisition price. As accelerators are able to attract more investors to invest in their portfolio companies than other types of early investors, the investors should have more control in accelerators' portfolio companies. Furthermore, as accelerators have typically close relationships with their portfolio companies even after they have graduated their programs, they have a lot of information about the quality of the startups. According to Kim and Wagman (2014) acceletators may themselves have incentives to exit their investments early in some cases. As they take a significant equity share early for relatively little investment and may even have exclusive rights to invest more in later rounds, accelerators should therefore have significant impact over the timing of exit in their portfolio firms.

H2: Companies that have graduated from premium accelerators are able to attract significantly more funding and investors than graduates from less prominent accelerators.

H3: Premium accelerators significantly shorten the time it takes to have a meaningful exit than the less prominent accelerators.

Taking into consideration the critique that the less prominent accelerators' impact on startup success is questionable, I aim to find evidence for this claim by proving that graduates from leading accelerators are able to raise more funding and attract more investors. To further find evidence for this, I expect to find that graduates from leading accelerators get acquired significantly younger than graduates from less prominent accelerators. The logic behind these hypotheses is that the leading accelerators have better networks and their certification matters more to investors than certification from a weaker accelerator.

H4: Less prominent accelerators do not impact the long-term outcomes of their portfolio companies any more than regular early stage venture capital investors.

Assuming evidence for the hypotheses two and three can be found, further analysis could show that less prominent accelerators are in fact harmul for some entrepreneurs. If the long-term outcomes of less prominent startup accelerators' graduate companies do not differ meaningfully from the outcomes of companies with regular early stage venture capital backing, the argument can be made that the weaker programs are not helpful for all entrepreneurs. If an entrepreneur manages to raise funding without certification from a startup accelerator, the entrepreneur would be then giving up a significant share of equity for little or no gain.

H5: Acquirers earn higher abnormal returns when the target is a startup accelerator graduate firm rather than when the target company is only backed by venture capital investors.

Assuming hypothesis one can be proven, investors might use their increased control over exit to accept a lower selling price for their portfolio companies, if it is in their interests. Furthermore, since startup accelerator involvement can signal higher quality and their portfolio companies are often assiociated with disruptive technologies, acquiring one of their portfolio companies might reveal information about the acquiring firm's future strategic plans, which could be reflected in the stock price reaction. I also expect to find that acquisitions of startup accelerator graduate firms have greater valuation uncertainty if they get acquired younger. As found by Ransbotham and Mitra (2010), this should lead to lower prices.

H6: Acquirers earn higher abnormal returns when the target firm is a premium startup accelerator graduate as compared to when the target firm is a graduate from a less prominent startup accelerator.

For similar reasoning as in hypotheses two and three, acquirers should be able to earn higher abnormal returns when the target firm is a graduate from a premium startup accelerator when other factors than startup accelerator quality are excluded from the comparison.

5 DATA AND METHODOLOGY

5.1 Acquisitions of startup accelerator backed firms

I began my data collection process by identifying startup accelerators that fit the description and criteria as described in chapter 2. Furthermore, to be included in the sample the accelerator has to have at least one exit where a portfolio company has been acquired by an U.S. headquartered company which has its stock listed either on AMEX, NASDAQ or NYSE. Table 2 lists the startup accelerators included in the sample and gives further information on their investment terms as well as their backers.

After identifying the startup accelerators, I compiled a sample of completed acquisitions that were announced between August 26, 2006 and April 7, 2016. The data was obtained primarily from Crunchbase which is a community-edited startup database. The data was supplemented with information from startup accelerators' webpages. The announcement dates for the acquisitions were confirmed by checking from various online publications covering private companies such as TechCrunch and Venturebeat. Also press releases of the acquiring and the acquired firms were used to check the data. To be included in the sample the following conditions must be satisfied:

1. The target is a privately held company that has participated in at least one accelerator program listed in table 2.
2. The acquiring company is U.S. headquartered and its stock was listed on the AMEX, NASDAQ or NYSE at the time of acquisition announcement.
3. The acquiring company has no publicly known equity share in the target firm.

Table 3 shows how the acquisitions are distributed by startup accelerator. Figure 2 shows the number of acquisitions by year.

As it can be seen from table 3, the majority of startup accelerators' exits are acquisitions while IPOs are rare. Out of 432 exits by acquisition, 132 fulfill the conditions above. For twelve acquisition events, there was not enough data to confirm the announcement dates and thus they were removed from the sample. In addition, there were five cases where the target firm had participated in two different accelerator programs. One of these cases was already removed from the sample due to lack of data to confirm the announcement date. Removing the four remaining duplicates, the final sample of acquisitions includes 116 unique observations.

Table 2.

Startup accelerators included in the sample, their investment terms and backers

The investment terms are percentage shares of equity in the portfolio company unless noted otherwise. VCs in the backers column is an abbreviation for a venture capital fund.

Accelerator	Investment terms	Backers
Y Combinator	7%	VCs and angel investors
Techstars	Up to 10%	VCs and angel investors
500 Startups	5% + follow-on right up to 500k or 20% of next round	VCs and accredited investors
DreamIT Ventures	5-8% or 25% of next round with 20% discount	VCs, angel investors, large corporations
Seedcamp	7,5%	VCs and angel investors
Alchemist Accelerator	5%	VCs and CVCs
AngelPad	7%	VCs and angel investors
AlphaLab	5% & 25k convertible note	Innovation Works (VC)
The Brandery	6% & 25 convertible note	VCs
FounderFuel	5%	VCs
PIE	6%	Large corporations
fbFund	Right of first refusal for the first round of financing	VCs and Facebook
Amplify.LA	5% & option for 10% more in exchange for 200k	VCs and angel investors
Launchpad LA	6% & option for 50k convertible note	Accredited investors
Betaspring	4-8% of revenue for 36 months	VCs
Imagine K12	6%	Founding team, Y Combinator (accelerator) and Acta Wireless (VC)
Rock Health	N/A	Private equity firms, large corporations
UpWest Labs	8%	Accredited investors
i/o Ventures	8%	Accredited investors

Sources: Company websites and various technology news publications.

Table 3.

Startup accelerators' exits

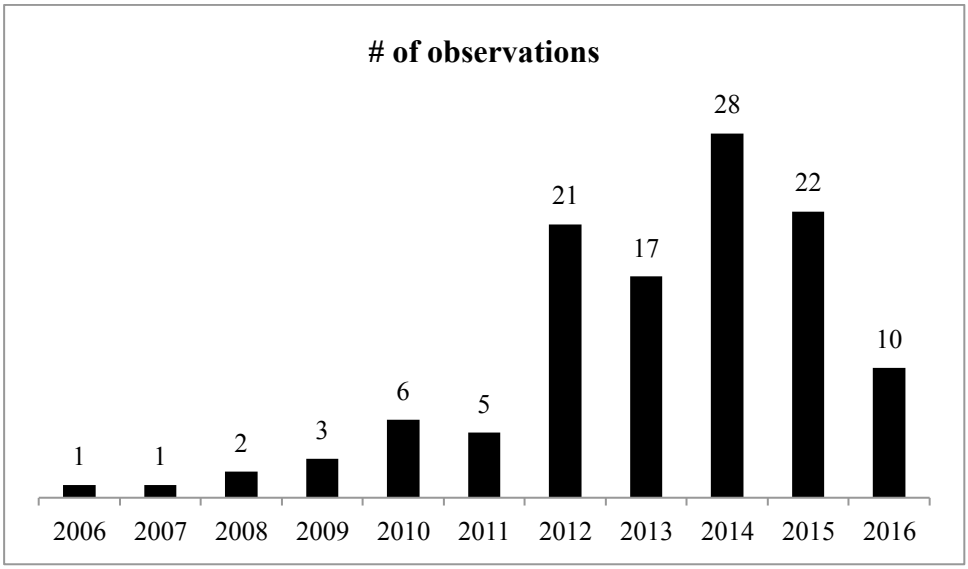
In the table Exits (total) represents the total number of successful exits including both acquisitions and initial public offerings. Acquisitions column is exits where the portfolio company has been acquired. By public companies –column is the number of acquisitions where the portfolio company has been acquired by a publicly listed company listed in AMEX, NASDAQ or NYSE. Date not available –column is the number of acquisitions by public companies where the acquisition announcement date could not be confirmed or it was not available in Crunchbase. Observations column is the number of companies acquired by publicly listed companies minus the number of observations where acquisition announcement date was not available.

Accelerator	Exits (total)	Acquisi-quisi-tions	By public companies	Date not available	Observa-tions
Y Combinator	133	132	50	4	46
Techstars	74	74	17	0	17
500 Startups	111	109	26	2	24
DreamIT Ventures	13	13	1	0	1
Seedcamp	18	18	3	0	1
Alchemist Accelerator	10	10	5	0	5
AngelPad	17	17	3	0	3
AlphaLab	4	4	3	0	3
The Brandery	4	4	1	0	1
Founder Fuel	6	6	4	2	2
PIE	2	2	2	0	2
fbFund	4	4	3	1	2
Amplify.LA	7	7	2	0	2
Launchpad LA	4	4	4	1	3
Betaspring	4	4	1	1	0
Imagine K12	3	3	1	0	1
Rock Health	11	11	2	0	2
UpWest Labs	4	4	2	0	2
i/o Ventures	6	6	2	1	1
TOTAL	435	432	132	12	120
- Duplicates (startup participated in two accelerators)			5	1	4
TOTAL without duplicates			127	11	116

Figure 3.

Number of acquisitions of startup accelerator backed firms by public companies

The figure shows the number of startup accelerator backed companies that got acquired each year by a publicly listed company in the U.S between August 26, 2006 and April 7, 2016. The acquisition year is determined by the acquisition announcement date. 11 companies were omitted because the exact acquisition announcement date could not be verified.



5.2 Event study methodology

The purpose of event study methodoly is to detect abnormal changes in stock prices occuring because of an identified ”event”. I take the acquisition announcement as my event to discover whether there are any patterns useful for trading. The typical event study methodology involves calculating cumulative abnormal returns.

I calculate the abnormal return using the capital asset pricing model (CAPM):

$$AR_{i,t} = R_{i,t} - \left[\beta_i * \left(R_{m,t} - R_{f,t}\right) + R_{f,t}\right]$$

where,

$AR_{i,t}$ is the abnormal return of stock i at time t

$R_{i,t}$ is the actual return of company i’s stock at time t

$R_{m,t}$ is the return of S&P 500 index at time t

B_i is the 3-year beta of company i’s stock against S&P 500

$R_{f,t}$ is the one-month U.S. treasury bill rate

The cumulative abnormal return, CAR, is defined as:

$$CAR_{i,(T_1,T_2)} = \sum_{t=T_1}^{T_2} AR_{i,t}$$

where,

T_1 and T_2 are the beginning and ending days of the event window.

I calculate the cumulative abnormal returns using 21-day time window. Time window is the time span around the event day during which the analysis is conducted. The event day, $t = 0$, is defined as the announcement day of acquisition. Thus 21-day time window is (-10, +10) days around the event day. This time window enables capturing the abnormal return better than shorter time windows because acquisitions of startups may in many cases be reported in news later than the actual acquisition announcement date. Furthermore, the acquisition announcements might themselves give investors more information about the acquiring company's future plans due to the high-tech nature of the acquired companies. Therefore there might be further news or speculation around the acquisition announcement date.

5.3 Other variables

Other variables in the analysis include:

AGE

The acquisition target's age in years. The age is calculated as the year of acquisition announcement minus the year the acquisition target was founded.

FUNDING

The total amount of equity funding in millions of U.S. dollars raised by the acquisition target before the acquisition announcement.

INVESTORS

The total number of different investors who have invested in the acquisition target. The figure also includes the startup accelerator as an investor if the acquisition target has participated in an accelerator.

5.4 Matching technique

I compare the acquisitions of accelerator-backed firms to acquisitions of venture capita backed firms. In order to ensure that the results are not affected by variations across different industries or different acquirer characteristics, this study employs a matched firm technique. For each startup accelerator backed firm that was acquired by a publicly traded company, I identify a similar venture capital investor backed firm acquired by the same company. To be included in the matched sample, a venture capital backed firm must have been acquired no more than 2 years before and 2 year later than the startup accelerator backed firm.

5.5 Statistical tests

To test whether a variable is statistically indifferent from zero, *t*-test is conducted with the following formula,

$$t = \frac{X}{\frac{s}{\sqrt{n}}}$$

where,

X is the sample mean,

s is the sample standard deviation,

n is the number of observations.

To test the difference between two sample means, the startup accelerator sample and the matched firms sample, across different variables, two-sample t-test is conducted with the following formula,

$$t = \frac{X_1 - X_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

where,

X_1 and X_2 are the sample means,

s_1^2 and s_2^2 are the sample variances,

N_1 and N_2 are the number number of observations (sample sizes).

The *t* values are compared to the critical values at the significance levels of 10%, 5% and 1% of the two-tailed test. The result is considered significant if the value of *t* is larger than the critical value. Finally the *t* values are converted into *p* values which are used in this paper to report the results.

6 RESULTS & ANALYSIS

6.1 Univariate comparison of startup accelerator backed firms and venture capital investor backed firms at the time of their acquisitions

I compare startup accelerator backed firms and firms backed only by regular venture capital investors along three dimensions in table 4 at the time they were acquired. To control for factors, such as for example different acquirer characteristics, described in section 5.4, if a data point for a variable could not be obtained for both the startup accelerator backed firm and its matched firm, the comparison does not include that pair. Therefore the number of pairs may be different for each variable.

Table 4.

Comparison of startup accelerator and only venture capital backed firms

The table compares startup accelerator and only venture capital backed firms along three dimensions at the time the firms were acquired. AGE rows report the average and median age of the firms in years. FUNDING rows report the average and median equity funding raised by the companies in millions of U.S. dollars. INVESTORS rows report the average and median number of different investors. Test of differences column reports the p-values from statistical difference tests between the two means or medians for each variable. The number of pairs column reports the number of acquired startup accelerator backed companies which could be matched with a venture capital backed firm where the data for both was available.

	Accelerator backed firms	VC backed firms	Test of differences (p-values)	Number of pairs
Average AGE	3,1	5,4	0,0001	102
Median AGE	3,0	4,0	0,0499	102
Average FUNDING	4,8	19,3	0,0028	39
Median FUNDING	2,5	7,3	0,3054	39
Average INVESTORS	8,6	6,5	0,1479	38
Median INVESTORS	6,5	5,0	0,2949	38

I find that firms which have participated in startup accelerator programs get acquired significantly younger, on average at 3.1 years old, than their venture capital backed counterparts (5.4 years). This difference in the acquisition target companies' ages also seems to be reflec-

ted in the amount of funding the firm raises before it gets acquired. On average, venture capital backed firms raise four times the amount of capital that startup accelerator backed firms raise before they get acquired. The difference between the two mean amounts of capital raised is statistically significant at 5% confidence level. However due to small number of matched pairs, this could not be confirmed by comparing the medians. The difference in the amounts of funding is mostly due to the fact that venture capital backed firms have had more time to raise funding as they get acquired older. Furthermore, funding is typically raised in rounds which increase in size. In my sample 56,9% of the 58 venture capital investor only backed firms for which data was available have had a Series A financing round or a later financing round. The same figure for the 119 startup accelerator backed companies for which data was available is 33,6%.

I also examine the number of different investors the firms have. Startup accelerator backed firms seem to have slightly more investors (on average 8.6) than their VC-backed peers (on average 6.5). The difference is not statistically significant but it is somewhat surprising taking into account that startup accelerator backed firms get acquired younger and raise less capital before getting acquired. This suggests that startups have better access to investors through accelerator programs and have better chances of raising capital as a result of the credibility gained by getting accepted to the accelerator program.

These results act as a proxy for testing my first hypothesis as equity ownerships of acquired companies were not public for my sample of acquired companies. My first hypothesis was that startup accelerator backed companies give more control over exit to investors than regular venture capital investor backed firms. Based on my findings, this hypothesis could not be completely confirmed. As regular venture capital backed firms get acquired later and raise more funding, one could expect these firms to give up a higher share of equity ownership. However startup accelerator backed firms have more investors which one could also expect to result in a higher share of equity held by investors. Furthermore, as discussed in section 2.2, firms backed by startup accelerators usually have given a small but significant share of equity to the startup accelerator for only a small amount of money.

6.2 Do better accelerators 'accelerate' more?

The Seed Accelerator Rankings Project (SARP) is a ranking of the top startup accelerator programs in the U.S. The ranking compares the performance of different accelerator programs and it is meant to provide advice for entrepreneurs who are thinking about participating in an accelerator program. SARP uses confidential data directly from participating startup accelerators and supplements it with public and proprietaty data sources. They also interview startup accelerator alumni, venture capitalists, angel investors and accelerator program directors. SARP's main assessment metrics are as follows:

- **Valuation:** Mean and median valuation across all portfolio companies. Since startup accelerators vary in age and their graduates might therefore be in different stages of development, SARP also considers valuations for the first three years since graduating from an acceletator program.
- **Qualified exit:** SARP considers issuing an IPO or getting acquired for an amount greater than $5 million above the amount of capital raised by the company to be a qualified exit. SARP then utilizes the percentage of startup accelerator program graduates that had a qualified exit.
- **Qualified fundraising:** SARP considers qualified fundraising to occur when a company that has raised an aggregate of at least $250,000[4]. SARP then utilizes the percentage of startup accelerator program graduates that had a qualified raise within the first 12 months of graduation and the percentage of graduates who have had a qualified raise up to the date when the data was measured.
- **Survival:** Percentage of startup accelerator graduate companies still in business. SARP considers survival at one, two and three years out from program end.
- **Founder satisfaction:** SARP surveys entrepreneurs who have graduated from startup accelerator programs. SARP asks two questions; whether entrepreneurs would repeat the program knowing what they know now about the experience, and whether they would recommend the program to a friend. The recommendation question is asked on a scale of 0-10 and it is used to calculate a Net Promoter Score (NPS) for each program.

The metrics used by SARP are discussed in more detail in the appendix 2. SARP ranked accelerator programs in 2014 from first place to last place but in later years it has categorized

[4] This threshold was lowered to $200,000 in the 2016 ranking.

programs by tiers. The highest tier in 2016 rankings was platinum. Combining the 2014 and 2016 rankings as well as the long term startup outcomes using the number of acquired portfolio companies as a proxy, I sort the accelerators in my sample into two categories; premium accelerators and standard[5]. I then compare the two categories of accelerators along three dimensions.

I find that graduates from premium accelerators do not get acquired any sooner than graduates from other less prominent accelerators. For both groups the average age at acquisition is around 3 years. However graduates from premium accelerators attract signicantly more funding, on average two times more, than graduates from other accelerators. The number of investors these companies have by the time they get acquired are in line with this finding. Graduates from premium accelerators have on average around eight different investors while graduates from other accelerators only have around four different investors. Table 6 summarizes these findings.

These results do not give any evidence for my third hypothesis that participating in a premium accelerator results in earlier acquisition. However there is strong evidence for my second hypothesis that participating in a premium accelerator gives a firm much better chances of attracting investors and raising funding. Both of these are of course critical for startup survival and therefore dramatically improve the chances of getting acquired in the first place. This can also be seen in my sample data as the more prominent accelerators have signicantly more exits than than the less prominent accelerators. Therefore from an entrepreneur's perspective, premium accelerators create much more value to their portfolio companies even though there is no difference in the time it takes to get an exit via acquisition.

[5] SARP uses metrics that evaluates startup accelerators mostly on short-term basis. Therefore some accelerators that could be considered premium solely on the basis of SARP rankings have been also evaluated on other metrics such as the number of exits.

Table 5.

Startup accelerator rankings and categorization

The table reports the Seed Accelerator Rankings Project's (SARP) ranking or category for each startup accelerator included in the sample. Category column reports whether a startup accelerator is considered premium or standard in this paper after taking into consideration SARP's rankings and the number of exits.

Accelerator	2014 ranking	2016 ranking	Category
Y Combinator	Not ranked	Platinum	Premium
Techstars	#3	Platinum	Premium
500 Startups	#8	Platinum	Premium
AngelPad	#1	Platinum	Standard
Alchemist Accelerator	#5	Platinum	Standard
Amplify.LA	#7	Platinum	Standard
DreamIT Ventures	#10	Gold	Standard
AlphaLab	#16	Silver	Standard
Betaspring	#19	Silver	Standard
The Brandery	Not ranked	Gold	Standard
FounderFuel	Not ranked	Not ranked	Standard
PIE	Not ranked	Not ranked	Standard
fbFund	Not ranked	Not ranked	Standard
Launchpad LA	Not ranked	Not ranked	Standard
Imagine K12	Not ranked	Not ranked	Standard
Rock Health	Not ranked	Not ranked	Standard
UpWest Labs	Not ranked	Not ranked	Standard
i/o Ventures	Not ranked	Not ranked	Standard
Seedcamp	Not ranked	Not ranked	Standard

Source: Seed Accelerator Rankings Project's 2014 and 2016 accelerator rankings.

Table 6.

Comparison of premium and standard accelerators

The table compares premium and standard startup accelerator backed firms along three dimensions at the time the firms were acquired. AGE rows report the average and median age of the firms in years. FUNDING rows report the average and median equity funding raised by the companies in millions of U.S. dollars. INVESTORS rows report the average and median number of different investors. Test of differences column reports the p-values from statistical difference tests between the two means and medians for each variable. N –columns report the number of observations for each variable for both premium and standard accelerators.

	Premium accelerator backed firms	N	Standard accelerator backed firms	N	Test of differences (p-values)
Average AGE	3,1	90	2,9	31	0,2652
Median AGE	3,0	90	3,0	31	1
Average FUNDING	6,2	67	2,5	22	0,0032
Median FUNDING	2,4	67	1,7	22	0,5679
Average INVESTORS	8,2	85	4,4	23	0,0004
Median INVESTORS	7,0	85	4,0	23	0,0021

6.3 Are all accelerator programs worth it?

As discussed in section 2, earlier literature finds that some startup accelerator programs might be detrimental to their portfolio companies. Hathaway (2016) suggests that some startup accelerator programs seem to have no impact or some accelerators might even slow down startup development. Based on my results it is rather clear that participating in a higher quality startup accelerator is a better choice, assuming one could get accepted to any accelerator program. The equity shares which entrepreneurs give to startup accelerators do not vary significantly between accelerators and therefore being able to attract more funding and investors among other benefits give more value for the same price[6]. However the most prominent startup accelerators are highly competitive and their acceptance rates are only few percent for each program. Then a question, whether startups that can not get accepted to the highest quality accelerators should participate in lower quality accelerators, arises. Their other option is to proceed without participating in an accelerator program and try to attract regular venture capital fun-

[6] Table 2 lists equity shares taken by different startup accelerators included in the sample.

ding, assuming the company needs funding. Another option would be to first participate in a lower quality accelerator to gain more traction that would help the company to get accepted into a more prominent startup accelerator. In my sample there were a couple firms that did this but I do not expect any startup to do this purposefully. Instead, I expect firms to only go this route if they didn't get similar benefits from the first program that they expected to get when entering the more prominent program later. Table 7 compares graduate companies from standard accelerators in my sample and their matched regular venture capital backed firms along three dimensions[7]. If a data point for a variable could not be obtained for both the standard startup accelerator backed firm and its matched firm, the comparison does not include that pair. Therefore the number of pairs may be different for each variable and the averages presented in table 7 may be different from table 4 and table 6.

Table 7.

Comparison of standard accelerator graduate companies and regular venture capital backed companies at time of acquisition

The table compares standard startup accelerator (i.e. less prominent accelerators as categorized in table 5) graduate companies and only venture capital backed companies at the time they were acquired. AGE row reports the average age of the firms in years. FUNDING row reports the average equity funding raised by the companies in millions of U.S. dollars. INVESTORS row reports the average number of different investors. Test of differences column reports the p-values from statistical difference tests between the two means for each variable. The number of pairs column reports the number of acquired startup accelerator backed companies which could be matched with a venture capital backed firm where the data for both was available.

	Standard accelerator backed firms	VC backed firms	Test of differences (p-values)	Number of pairs
Average AGE	3,0	5,4	0,0080	25
Average FUNDING	2,1	9,3	0,0902	8
Average INVESTORS	4,4	5,1	0,7862	7

[7] Premium accelerators are not included in the comparison since it was already showed in section 6.1 that overall startup accelerators do shorten the time it takes to get acquired. Furthermore, section 6.2 already shows that premium accelerators do work better than less prominent ones.

I find that, when comparing standard accelerator backed firms and their matched peers with only venture capital investor backing, the firms do not differ on certain characteristics from the results from comparing the entire sample of all startup accelerator backed firms with their matched regular venture capital backed firms. Standard accelerator backed firms get still acquired significantly earlier when compared to their venture capital investor backed peers. Venture capital backed firms also seem to attract more funding even though this could not be confirmed statistically due to the sample size of matched companies being relatively small. One difference when comparing the results to those of the comparison of the entire sample of all accelerators and their matched venture capital backed peers is the average number of investors the companies have at the time of their acquisition. The results indicate that standard accelerator graduates seem not be able to attract any more investors than their matched venture capital investor backed peers. Even though the sample size of matched pairs is small, the result suggests that this is where standard accelerators fail to provide value to their portfolio companies. However based on these results a conclusion, that the less prominent startup accelerators are not beneficial to their portfolio companies, can't be made. Instead the most plausible reason explaining these results is that startups participating in less prominent accelerator programs weren't the highest quality startups in the first place. Thus my fourth hypothesis could not be confirmed.

6.4 Abnormal returns to acquirers of startup accelerator backed firms

From the sample of 116 acquisitions of startup accelerator backed companies for which there was data available to calculate abnormal returns, 110 firms could be matched a similar venture capital investor backed firm. Table 8 compares the abnormal returns to acquiring companies when acquiring startup accelerator backed firms and regular venture capital investor backed firms.

I find that abnormal returns to acquirers are on average significantly positive, 2.1%, when acquiring a firm that has participated in a startup accelerator program. The abnormal returns are on the other hand significantly negative when acquiring a regular venture capital investor backed firm; on average -2.1%. This result confirms my fifth hypothesis.

Table 8.

Cumulative abnormal returns to acquiring companies

The table reports cumulative abnormal returns (-10, +10) to acquiring companies when they acquire startup accelerator backed companies and companies backed only by venture capital firms. Test of differences column reports the p-values from statistical difference tests between the two means and medians respectively. The number of pairs for the acquisitions of startup accelerator backed and venture capital investor backed firms in the sample is 110.

	Acquisitions of accelerator backed firms	Acquisitions of VC backed firms	Test of differences (p-values)
Average CAR (-10, +10)	2,11 %	-2,11 %	0,005
Median CAR (-10, +10)	0,81 %	-2,09 %	0,055

As startup accelerator backed companies get acquired younger and with less raised funding, this makes them harder to value. Typically a company's financial value is based on profits and its future cash flows. However for younger tech startups, profits might be small or even negative and the future cash flows might be difficult to estimate. Therefore it is much more likely that these firms are valued by acquirers based on how the target company fits on their short or long term strategies. Thus one potential explanation for the differences in the abnormal returns to acquiring companies is that the acquisition announcements where the target is an acceletator program graduate reveal more information on the acquiring company's future plans while the acquisitions of regular venture capital backed investor companies are more based on financials.

My results are well in line with previous literature. As noted by Ragozzino and Blevins (2016), a higher number of venture capital investors increases the likelihood of an acquisition but they found no evidence for the total amount of funding having impact on the likelihood of an acquisition. Therefore Ragozzino and Blevins' finding supports the hypothesis that startup accelerator backed firms seem to give more control over exit to their investors when compared to only venture capital backed firms. Furthermore, since most venture capital firms' funds have a fixed maturity, this also helps to explain why startup accelerator backing results in higher acquirer returns.

My results also provide some support for the argument that startup accelerators might help reduce information asymmetry between the acquiring company and the target company. As

noted by Gompers and Xuan (2008), acquirers earn more positive returns around the acquisition announcement date when information asymmetries are lower. Startup accelerators, at least the most prominent ones, have connections to a wide network of large corporates, investors and other stakeholders, and they also work closely with their portfolio companies. Thus they have high potential to reduce information asymmetries for the good of all parties involved in the acquisition transaction. However as suggested by Kim and Wagman (2014), startup accelerators have an incentive to exit their investments earlier if they learn that a portfolio company might have less potential than initially thought. Therefore they might be ready to accept a lower acquisition price and use their control rights to make the founding entrepreneur also accept the offer.

6.5 Does accelerator quality matter for acquiring companies?

Acquiring companies earn higher abnormal returns when they acquire premium accelerator backed firms as compared to other less prominent accelerator backed firms. I find that the average abnormal return is 3,2% for acquisitions of premium accelerator backed firms and 0,3% for other accelerator backed firms. However the difference between the two means is not statistically significant (p-value 0,27). Therefore my sixth hypothesis could not be confirmed. However this result suggests that mostly due to similar factors when comparing acquisitions of startup accelerator graduate companies and only venture capital investor backed companies, premium accelerator backing might result in slightly higher acquirer returns if there was a bigger sample.

From potential acquirer's perspective the main question regarding a startup accelerator's role in the development of the target company is how exactly does the accelerator's involvement signal quality. If the acquirer's motive for the acquisition is bringing in talent, then prominent accelerators are likely to come ahead. The argument made by Hallen, Bingham and Cohen (2016) was that consultation provided by accelerators to their portfolio companies is the key driver for better venture outcomes. As prominent accelerators have more more resources, they are able to provide higher quality consultation and thus they are able to increase more the skills of entrepreneurs participating in their programs. The more prominent accelerators also have wider networks of mentors working with portfolio companies and more alumni. This might come to importance when the target company gets acquired younger. As mentioned in section 3.1, younger tech companies are difficult to value and their valuations are more de-

termined by how they fit with the acquiring company's strategy. When the acquisition is driven by strategic value rather than financial synergies, there has to be an internal champion internalizing the reasons for the acquisition. Thus the wider networks of prominent accelerators might increase the likelihood of an acquisition. Furthermore, if the acquisitions of startup accelerator graduate companies are mostly driven by strategic value, the more prominent accelerators might be better in reducing information asymmetries.

7 LIMITATIONS

Since the startup accelerator phenomenon is relatively new, the biggest limitation of this study is small sample size. As noted earlier, some of the hypotheses could have been confirmed if there was a bigger sample size. Another limitation of the sample data is that it might only take into account successful cases. The data for accelerator participation was collected from Crunchbase, which is a community updated database. Therefore it gives investors and startup founders a chance to purposefully omit or hide data from Crunchbase. This might be especially problematic in cases where investors have managed to get control over exit and decided to sell the company against founding team's wishes or in cases where founders may have been forced to give up operative duties in their companies.

8 CONCLUSIONS

8.1 Summary of findings

This papers studies the startup accelerator phenomenon and the long-term impacts of startup accelerators. More specifically, I study startup accelerator backed firms at the time of their acquisition. Based on hand-collected data in the United States over nearly a 10 year period, I examine these firms both from the entrepreneur's perspective and the acquiring company's perspective.

Matching firms that have graduated from a startup accelerator program with firms that have only had regular venture capital financing, I find that startup accelerator graduates get acquired significantly younger than their matched peers. This difference in age is however reflected in the amount of funding that these firms raise before they get acquired. Firms backed only by venture capital investors raise on average four times more funding than startup accelerator graduates. Despite getting acquired younger and raising less funding, startup accelerator graduates still have on average sligthly more investors than their matched peers. Overall, these results suggest that startup accelerator programs have a positive impact on their portfolio companies and the accelerators indeed 'accelerate' the development of startups.

Startup accelerators take a meaningful share of equity for an investment that is typically significantly lower than normal early stage venture capital investment. Thus entrepreneurs expect to get other benefits, such as connections with investors and consultation, to compensate for this difference. I find significant differences in the amount of funding and number of investors when comparing graduate firms from the most prominent accelerators to those who have graduated from less prominent accelerators. Even though these results are strong indicators of startup success, I find that successful companies from the less prominent accelerators still get acquired significantly younger than their venture capital investor backed peer firms. These results confirm that in general all accelerators are able to speed up the development of startups.

I study the acquisitions of startup accelerator graduate firms from an acquiring company's by analyzing the abnormal stock returns around the acquisition announcement dates. I find that announcements of startup accelerator backed companies result in significantly higher abnormal returns when compared to announcements of acquisitions of regular venture capital inves-

tor backed firms. The most likely reason for the higher abnormal returns in acquisitions of startup accelerator backed firms is the amount of control startup accelerator backed firms give to their investors. As mentioned earlier, startup accelerators take significant equity ownership, but they don't provide significant funding in return. Furthermore, startup accelerator graduates have more investors than their matched peers which could increase the chances of an earlier exit since most venture capital funds have fixed maturities. Startup accelerators also might have an incentive to exit their investments early since they rely partly on their track records of successful portfolio companies. Another explanation for the differences in abnormal returns is that startup accelerator involvement could help reduce information asymmetries, which have been shown in previous literature to impact abnormal returns. Startup accelerators work closely with their portfolio companies during and after the accelerator programs. They also have wide networks which makes them ideally positioned to reduce information asymmetries. A third potential explantion for the difference in abnormal returns is that acquisitions of startup accelerator graduates reveal valuable information about the acquiring company's future plans to the stock markets. Since startup accelerator graduates get acquired at younger age and with smaller valuations, they are difficult to value based on profits or by modelling future cash flows. Instead, they are more likely to be valued by how well they fit on the acquiring company's short or long term strategies.

8.2 Suggestions for further research

As the first modern startup accelerators only emerged in mid-2000's, there has only been limited amount of earlier research on the topic. Furthermore, it usually takes multiple years until startups have an exit either through an IPO or an acquitision. Therefore, most earlier papers studying startup accelerators focus on shorter time periods. Only recently, there has been enough data to study the longer term outcomes and impacts of accelerator programs.

The results presented in this paper suggest that entrepreneurs might be able obtain better valuations for their companies when their companies are getting acquired if they had not participated in a startup accelerator. However as the data is only available for succesful exits, the result does not take into consideration that the likelihood of a succesful exit or even startup survival is lower had the startup not participated in a startup accelerator program. As the results in this paper show, especially first-time founders benefit significantly from startup accelerator programs as they may lack skills and networks to raise funding. However it may be interesting to

study if previously successful entrepreneurs have better outcomes when compared to startup accelerator graduates.

As the biggest limitation of this paper is a relatively small sample size, some of the hypotheses could not be verified with statistical tests. Therefore many of these hypotheses could be tested again in the future as more data becomes available. Another research opportunity would be to include acquisitions from multiple countries to make the sample size bigger. With more data in the future, studying also the impact of growing cohort sizes of startup accelerator programs may become possible.

Many large companies have launched their owned startup accelerator programs or they have partnered with an established startup accelerator. This may offer further research opportunities in the future for comparing the longer term outcomes of the sponsored programs compared to generic programs.

APPENDIX 1: Descriptions of accelerators included in the sample

Accelerator	Description
Y Combinator • Years operative: 2005 - present • Location: Mountain View, California • Website: http://www.ycombinator.com	Y Combinator is a leading American seed accelerator with combined over $80 billion valuation of portfolio and alumni companies. In the main program, Y Combinator selectes two batches of startups each year.
Techstars • Years operative: 2006 – present • Location: Boulder, Colorado • Website: https://www.techstars.com	Techstars is one of the largest accelerators with different programs in major cities around the world. It also offers a variety of vertical programs typically in co-operation with large corporations.
500 startups • Years operative: 2010 – present • Location: Mountain view, California • Website: https://500.co	500 Startups is a global startup accelerator which has invested in over 2000 companies. The seed program is 4-months long and it is run both in San Francisco and Mexico City.
DreamIT Ventures • Years operative: 2008 – present • Location: Philadelphia, Pennsylvania • Website: http://www.dreamit.com	DreamIT ventures offers 14-week programs based in Philadelphia and New York. More than 300 startups have participated in DreamIT's programs. The recent programs have focused in specific indusries such as health, edtech and urban tech.
Seedcamp • Years operative: 2007 – present • Location: London, United Kingdom • Website: http://seedcamp.com	Seedcamp is an early-stage investor founded by a group of 30 European investors. Originally modeled after the Y Combinator model, Seedcamp has since shifted towards first round investments. Seedcamp has invested in over 250 companies.
Alchemist Accelerator • Years operative: 2012 – present • Location: San Francisco, California • Website: http://alchemistaccelerator.com	Alchemist Accelerator is an accelerator that focuses on startups whose revenue comes from enterprises. The accelerator is backed by some of the most well-known VC funds and strategic corporate investors.
AngelPad • Years operative: 2010 – present • Location: San Francisco, California • Website: https://angelpad.org	AngelPad is one of the most selective accelerator programs with relatively small cohort sizes. The Seed Accelerators Ranking Project has ranked AngelPad in the top tier both in the 2016 and 2017 studies.

Accelerator	Description
AlphaLab • Years operative: 2008 - present • Location: Pittsburgh, Pennsylvania • Website: http://alphalab.org	AlphaLab is a nationally ranked software startup accelerator. It was founded by Innovation Works, Pittsburgh's largest seed-stage investor, to accelerate the growth of promising companies in the region.
The Brandery • Years operative: 2010 – present • Location: Cincinnati, Ohio • Website: http://brandery.org	The Brandery is a seed stage accelerator which specializes in branding, marketing and design. The accelerator works actively with creative agencies and it is sponsored by large corporations.
FounderFuel • Years operative: 2009 – present • Location: Montréal, Canada • Website: http://founderfuel.com	FounderFuel is a leading accelerator in Canada. It offers 3-month programs once a year with cohort sizes of around 10 companies. FounderFuel has accelerated over 80 companies.
PIE • Years operative: 2011 - 2014 • Location: Portland, Oregon • Website: http://www.piepdx.com	The Portland Incubator Experiment, or PIE, started as a coworking space but started running 3-month accelerator programs in 2011. It is run by the advertising agency Wieden+Kennedy.
fbFund • Years operative: 2009 – 2010 • Location: Palo Alto, California • Website: N/A	FbFund was an accelerator providing micro-seed investments to startups developing applications and websites related to Facebook. It was administed by Accel and Founders Fund, two very prominent VC firms.
Amplify.LA • Years operative: 2011 – present • Location: Venice, California • Website: http://amplify.la	Amplify offers four-month accelerator programs with rolling start dates instead of the typical "class-based" structure. As a part of their model Amplify also doesn't have demo days but instead has showcases where investors can meet with preselect companies.
Launchpad LA • Years operative: 2009 – present • Location: Santa Monica, California • Website: http://launchpad.la	Launchpad LA was originally started as a mentorship organization but started offering accelerator programs in 2011. The accelerator program is modeled after the Techstars and Y Combinator models.

Accelerator	Description
Betaspring • Years operative: 2009 - 2014 • Location: Providence, Rhode Island • Website: -	Betaspring was a high-ranked accelerator that run two 13-week programs a year. During its operation, 89 companies participated in Betaspring's accelerator programs.
Imagine K12 • Years operative: 2011 – present • Location: Redwood City, California • Website: http://www.imaginek12.com	Imagine K12 is a startup accelerator that focuses on startups creating products and services for the education industry. The accelerator merged with Y Combinator in 2016 and currently operates as its education vertical.
Rock Health • Years operative: 2010 – present • Location: San Francisco, California • Website: https://rockhealth.com	Rock Health is a seed fund investor that was started as a startup accelerator. Rock Health focuses on digital health startups. The accelerator model was dispensed in the autumn of 2013.
UpWest Labs • Years operative: 2012 - present • Location: Palo Alto, California • Website: http://upwestlabs.com	UpWest Labs is an accelerator that focuses on Israeli entrepreneurs looking to enter the US market or have already established presence in the US. In 2015, UpWest also started also investing in more mature startups looking to raise Series A and beyond.
I/o Ventures • Years operative: 2010 – present • Location: San Francisco, California • Website: http://ventures.io/	I/o Ventures is a startup accelerator that runs 6-month programs with relatively small batch sizes. I/o Ventures also operates a co-working space in the same space it runs its programs.

APPENDIX 2: Seed Accelerator Rankings Project criteria and assessment metrics

The Seed Accelerator Ranking Project (SARP) is an independent research entity run by Yael Hochberg (Rice University and MIT Innovation Initiative Lab), Susan Cohen (University of Richmond) and Daniel Fehder (MIT Innovation Initiative Lab). SARP ranks startup accelerators based on relative performance along multiple dimensions that may be important to entrepreneurs.

Inclusion criteria

SARP invited over 150 programs to participate in the rankings both in 2014 and in 2016. To be included in the rankings, programs had to meet the following criteria:

- Meet the definition of a startup accelerator: a fixed term, cohort-based program with a mentorship and education component that culminates in a public pitch event, or demo day
- Have graduated at least one cohort and have at least 10 alumni
- Based in the U.S.
- Be willing to provide transparency

The SARP team notes that while some accelerator programs meet the criteria, there is still some level of self-categorization. For example Y Combinator was not included in the 2014 ranking but would have been at the top of the ranking if they chose to participate. Overall, SARP used self-definitions of accelerators for the purpose of exclusion from the rankings project in 2014. However in 2016 self-definitions as a purpose of exclusion seems to have been dropped.

Measures used to compute the rankings

- **Valuation:** Valuations for portfolio companies are determined when a firm has a priced round. SARP considers mean and median valuations both across all portfolio companies, counting those that had not had priced rounds as zeroes, and conditional upon having obtained priced financing. Since startup accelerators vary in age and their alumni may be in later stages of development with correspondingly higher valuations,

SARP also considers valuations one year out from program completion, two years out from program completion and three years out from program completion.

- **Qualified exit:** SARP considers issuing an IPO or getting acquired for an amount greater than $5 million above the amount of capital raised by the company to be a qualified exit. A qualified exit indicates that the entrepreneur and other investors can cash out if they wish. SARP chose the $5 million threshold to represent a sum of money that would materially affect an entrepreneur's life. SARP utilizes the percantage of alumni companies that had a qualified exit in its ranking.
- **Qualified fundraising:** SARP considers qualified fundraising to occur when a company that has raised an aggregate of at least $250,000 (this threshold was lowered to $200,000 in the 2016 ranking). SARP chose the threshold to represent a sum of money that exceeds the guaranteed investment capital typically available to any particular accelerator's graduates through convertible notes. SARP's ranking utilizes the percentage of program alumni companies that have had a qualified raise within 12 months of graduation, the percentage of alumni had a qualified raise to date, and the mean and median amounts raised by these two points in time both across the entire portfolio unconditionally counting companies that did not raise as zeroes and conditional on fundraising.
- **Survival:** Percentage of alumni companies still in business. SARP considers survival at one, two and three years out from program end.
- **Founder satisfaction:** SARP uses a survey to determine founder satisfaction. SARP asked entrepreneurs whether they would repeat the accelerator program knowing what they know about the experience and whether they would recommend the program to a friend. The recommendation question is asked on a scale of 0-10 and was used to compute a Net Promoter Score (NPS). Those who answer 9 or 10 are promoters, those who answer 7 or 8 are passives and those who answer 6 or below are detractors. The percantage of detractors is then substracted from the percentage of promoters to determine NPS.

SARP gives metrics within these categories different weights and categories are then weighted to produce an overall score. SARP's ranking gives relatively higher weightings for valuations, fundraising and exits while a relatively lower weighting is given to survival.

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